Non–traditional white soft cheese from Fresh milk with added skim milk powder and different vegetable oils

By

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Summary

Firstly eight samples of different non-traditional white soft cheeses locally made were collected randomly from local market and evaluated for chemical composition. The average of fat content in these cheeses was 30.38% and the protein was 4.49%. Ash, salt, acidity and pH values indicated wide ranges for all the examined samples. Also, the rang of total solids was 35.44 to 49.64% and this wide range within the Egyptian legal standard for soft white cheese. *Secondly* non-traditional soft white cheeses were manufactured from a mixture of buffaloes and cows milk (1:1), 10% skimmed milk powder with added vegetable oils. The mixture was divided to four parts: (1) mixed with 20% cocoa butter substitute T1, (2) mixed with 20% cocoanut oil T2, (3) mixed with 20% palm oil T3 and (4) mixed with 15% palm oil + 5% cocoa butter substitute T4. The control cheese made from mixed buffaloes and cows milk (1:1) by the traditional methods. The chemical analysis indicated that there are significant differences between the treatments and control cheese in the total solids and the highest value was for T1 which recorded 43.9%. The same previous observation was for fat and lactose. However, there was non-significant differences for fat and lactose between the treatments but they were significant with control cheese. Also, cheese treatments indicated less acidity and high ash, salt than the control cheese. Sensory evaluations indicated that T1 which contains 20% cocoa butter substitute (CBS) was more closed to the control cheese.

Keywords: soft cheese, vegetable oils, cocoa butter substitute(CBS), skim milk powder, coconut oil , palm oil

Introduction

Non–traditional white soft cheese is a product growing importance because of its readily controllable characteristics especially for developing countries.

In such cheese, milk fat is replaced by vegetable oils, to reduce the capital cost of the production or for healthy use. In Egypt there was fast growing in non–traditional white soft cheese in last 10 years, these cheeses containing different types of vegetable oils and different ingredients according to the manufacturers. These products do not have enough labeling information's to classify these cheeses. Some of these additives cause certain defects in the flavour and consistency of the cheese.

So, this work was carried out to compare and contrast the chemical composition of some non–traditional white soft cheeses available in the Egyptian market in order to provide enough data on the product constituents and hence to formulate the appropriate composition of the experimental non–traditional white soft cheese.

Also non–traditional white soft cheeses were manufactures with a mixture of skim milk powder, different vegetable oils and fresh milk for selecting best vegetable oil for producing non–traditional white soft cheese superior to traditional cheese in the quality.

MATERIALS AND METHODS

1. Materials:

Market non-traditional white soft cheeses samples:

Eight different non–traditional white soft cheese samples were collected randomly from local markets in the same day of production. Cheese samples were analyzed chemically. The samples were collected three times from the same places at intervals of three months.

Table (1) Row materials used in the manufacture of non-traditional white soft cheeses

Materials	Supplier
Raw milk	Fresh mixed milk (cow and buffaloٮs, 1:1) used in this study was obtained from the herds of Faculty of Agriculture, Moshtohor, Benha University, Egypt
Skim milk powder (SMP)	Low heat skim milk powder was purchased from local market, which imported from California Dairies, Inc, Fresno, California, USA.
Shortening (Palm oil)	Pure palm oil was obtained from MIGOP Company, Suez, Egypt
Coconut oil	Pure coconut oil premium quality ”Meizan Brand” was purchased from local market, which imported from B.G.I.O. Edible oils (SDNBHD) paser gooding, Maliza
Cocoa butter substitute	Super "ERCOAT CBS" cocoa butter substitute was obtained from International Egyptian Food Company (IEFCO Egypt), Attaqa, Suez, Egypt.
Stabilizer	Lacta–815 was obtained from Misr Food Additives (MIFAD) Company, Giza, Egypt.
Salt	Commercial fine grade salt was obtained from the Egyptian Salt & Minerals Company (EMISAL), Egypt.

Rennet	Microbial rennet powder (Formase TL2200) was obtained from Chr. Hansen's Laboratories, Copenhagen, Denmark.
Calcium chloride	Calcium chloride was obtained from El-Nasr Pharmaceutical Chemicals Co., Cairo, Egypt.

2. Methods:

Cheese manufacture:

Non–traditional white soft cheese was produced using a mixture of 10% skim milk powder (SMP), 20% [cocoa butter substitute (T1), palm oil (T2), coconut oil (T3) or palm oil & coconut oil (T4)] and whole buffaloes and cows milk 1:1. The cheeses were produced according to the flow diagram shown in Fig (1). The control cheese was manufactured according to Fahmi and Sharara 1950 from fresh cows' and buffloes' milk. The resultant cheeses were analyzed for chemical and organoleptic properties when fresh comparing to the control one. All the experimental repeated three times and the analysis were done in duplicated.

Table (2): Gross chemical composition of raw milk, skim milk powder and vegetable oils used for non-traditional white soft cheese making.

Parameter %	Raw milk	Skim milk powder (SMP)	Palm oil	Coconut oil	Cocoa butter substitute (CBS)
Moisture	86.10	3.94	0.41	0.74	0.22
Protein	3.42	35.34	0.42	0.83	0.94
Fat	4.77	0.4	97.5	96.5	97.1
Lactose	4.83	53.67	–	–	–
Ash	0.75	6.65	1.67	1.94	1.73
Titratable Acidity	0.17	–	–	–	–
pH	6.66	6.72	6.79	6.75	6.81
Specific gravity	1.03	–	–	–	–

Methods of analysis:

Chemical analysis:

(Total solids, fat and salt contents), (Titratable acidity, ash contents and pH values), Lactose content, Total nitrogen (TN) and Soluble nitrogen (SN) contents of milk and cheeses were determined according to the methods described by BSI (1989). AOAC (1995). Lawrence (1968) and AOAC (1995), respectively.

The soluble tyrosine & tryptophan contents were determined spectrophotometrically according to Vakaleris and Price (1959) while Total Volatile Fatty Acids (TVFA) was determined according to Kosikowski (1978);

Organoleptic properties evaluation: Samples of fresh cheeses were organoleptically evaluated according to the scheme described by, IDF (1995). The evaluations were carried out by regular scoring panels (15 panelists) of staff members at Food Science Department, Faculty of Agriculture, Benha University and Dairy Research Dept., Food Technology Research Institute, Agriculture Research Center, Cairo, Egypt.

Statistical analysis: Statistical analysis was performed according to the user's guide given by **SAS Institute (1998).**

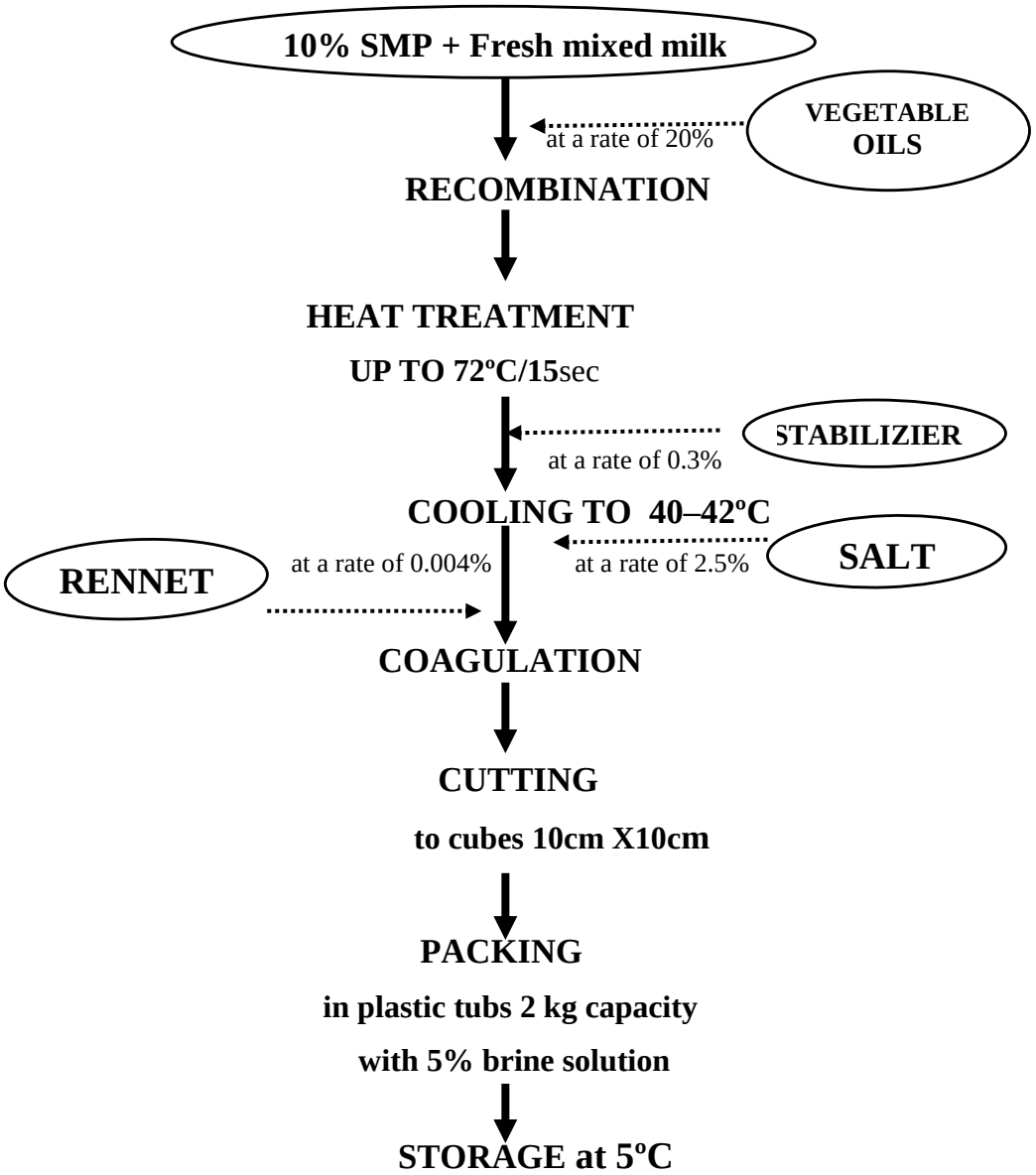

Fig (1): Flow diagram of making white soft cheese using non–traditional method with addition of skim milk powder and vegetable oils

Results and Discussion

Chemical composition of some non–traditional white soft cheeses available in the local markets

The chemical composition of some non–traditional white soft cheeses are presented in Table (3). The total solids content ranged from 35.44% to 49.64% with a mean value of 42.86% (S.D ±4.83). All the analysed cheeses were in the range of the Egyptian Standard (2005) for soft cheese.

The fat content, ranged from 24.50 to 40.00% with a mean of 30.38% (S.D ±5.57). This high level of fat content is related to the use of extra vegetable oils instead of milk fat to reduce the cost of cheese making. The vegetable oils are the cheapest fat in the market and such fat gives better properties of cheese texture.

The protein content of cheese was varied widely ranging from 2.97% to 6.20% with a mean of 4.59% (S.D ±1.18), which was relatively low. This reduction may be due to the use of different ratios of dry milk to increase the total solids of cheese milk during manufacture of such cheese. It was noticeable that the protein/DM percent ranged from 6.49 to 14.63%. These results are relatively low when compared with protein/DM content in traditional soft cheese, which ranged from 26.46 to 59.33% (El-Alfy *et al.*, 2004).

The lactose content of cheese was high as it ranged from 3.91 to 5.67% with a mean of 4.84% (S.D ±0.65). The high ratio of lactose is due to the skim milk powder used in making these cheeses. Also, the observation for lactose/DM percent was high as it was ranged from 8.46 to 13.96%.

In fact the protein/lactose ratio considers being one of the most important factors that affects the cheese texture. From the obtained results, the protein/lactose ratio characterized in such cheeses with lower range from 0.66 to 1.17% compared with traditional cheese type which have a range of 3.11 to 3.99%. These low ratios induced cheese to be soft and always occasion curd solubility.

The salt content of all cheese samples was fluctuated from 1.6 to 4.15%. However, the ash ranged from 2.15 to 4.47%. The obtained data are in accordance with EL-Beialy (1998).

Regarding to titratable acidity and pH values of all cheese samples, there was a wide range of the titratable acidity from 0.20 to 1.14%, also, the same for the pH values which ranged from 3.04 to 6.27. The variation of titratable acidity and pH values may be attributed to the addition of some acidulance such as Glucono Delta Lactone (GDL) as acidic substance during making these cheeses according to the manufacturer methodology. These results are in agreement with those mentioned by Kosikowiski (1978) and EL-Beialy (1998).

Table (3): Chemical composition of some non–traditional white soft cheeses available in the local Egyptian markets.

Parameter (%)	*Sample No.									LSD	
	1	2	3	4	5	6	7	8	Mean	5%	1%
T.S	43.78^{c}	35.44^{e}	37.04^{e}	49.64^{a}	46.38^{b}	44.28^{c}	45.74^{bc}	40.61^{d}	**42.86**	**1.882**	**2.534**
Fat	29.10^{d}	25.13^{e}	25.20^{e}	40.00^{a}	32.75^{c}	30.63^{cd}	35.70^{b}	24.50^{e}	**30.38**	**2.385**	**3.212**
Protein	6.20^{a}	3.55^{d}	3.91^{c}	3.87^{c}	5.11^{b}	5.20^{b}	2.97^{e}	5.94^{a}	**4.59**	**0.293**	**0.394**
Protein/DM	14.16	10.02	10.56	7.80	11.02	11.74	6.49	14.63	**10.80**	–	–
Lactose	5.29^{a}	3.91^{b}	4.50^{b}	4.20^{b}	5.47^{a}	5.22^{a}	4.49^{b}	5.67^{a}	**4.84**	**0.648**	**0.873**
Lactose/DM	12.08	11.03	12.15	8.46	11.79	11.79	9.84	13.96	**11.39**	–	–
Protein/lactose	1.17	0.91	0.87	0.92	0.93	1.00	0.66	1.05	**0.94**	–	–
Salt	2.43^{c}	2.82^{b}	2.83^{b}	1.60^{e}	2.58^{c}	2.60^{c}	2.18^{d}	4.15^{a}	**2.65**	**0.214**	**0.288**
Ash	3.19^{b}	3.06^{bc}	3.22^{b}	2.15^{e}	2.92^{c}	3.07^{bc}	2.52^{d}	4.47^{a}	**3.08**	**0.212**	**0.285**
Acidity	0.20^{e}	0.41^{d}	0.46^{d}	0.94^{b}	1.13^{a}	0.23^{e}	1.14^{a}	0.74^{c}	**0.66**	**0.126**	**0.170**
pH value	6.27^{a}	4.17^{b}	3.89^{cd}	3.04^{F}	3.84^{d}	6.12^{a}	3.44^{e}	4.05^{bc}	**4.35**	**0.190**	**0.256**

*Sample No. : From 1 to 8 corresponding to survey of fresh non–traditional white soft cheese purchased from local markets.
Values with the same letters are non significant different.

Chemical composition of non–traditional white soft cheese made from mixed fresh cows' and buffaloes' milk fortified with skim milk powder and different vegetable oils

Total solids content:

Total solids content of fresh non–traditional white soft cheese made from mixed fresh cows' and buffaloes' milk fortified with skim milk powder and different vegetable oils compared with the control cheese (traditional Domiati cheese) are shown in Table (4). Total solids content of fresh cheese samples was 36.62, 43.90, 43.06, 43.52 and 42.93% for control, T1, T2, T3 and T4, respectively. The total solids content was higher in T1 than all treatments. It was reported that the total solids content was slightly affected by the kind of vegetable oil used. Treatment with 20% cocoa butter substitute (CBS) (T1) had the highest total solids content. The slight differences between the cheeses made by using different types of vegetable oils may be due to the differences in protein contents and the kind of vegetable oil of such cheeses and its ability of holding moisture. The obtained results are in agreement with that of Abd El-Halim *et al.,* (2007). All the experimental cheeses were in the range of the Egyptian Standard (2005) for soft whit cheeses.

Statistical analysis of the TS data cleared that there were significant differences between the control cheese and other cheese treatments; however, there were non significant differences between all the cheese treatments (non–traditional cheeses) at levels of 5 and 1% with LSD of 1.072 and 1.461, respectively.

Fat and F/DM contents:

Results of Table (4) represent fat and F/DM contents of the fresh non–traditional white soft cheese as compared with control cheese. Fat content of fresh cheese was 17.75, 27.42, 27.08, 27.20 and 26.75% for control, T1, T2, T3 and T4, in order. The data indicated that the fat content of treatments with various vegetable oils was significantly higher than the control. This may be due to the higher percentage of vegetable oil added which associated with lower moisture content.

On the other hand, there were slight differences in fat content among non–traditional white soft cheese treatments due to the adjustment of fat percent in the cheese mix during cheese making. However, the control cheese was dependant on fat percent in the initial milk. Also, the same trend was observed for F/DM. Similar results were observed by Mehanna *et al.,* (2002) for making white soft cheese.

The statistical analysis of fat data indicated that there were significant differences between the control cheese and the other cheese treatments at level of 5 and 1% with LSD 0.911 and 1.242, respectively. On the other hand, the analysis of variance revealed that there were non significant differences between the cheese treatments (T1 to T4). This is due to the adjustment of fat percent in such cheese mix.

Protein and P/DM contents:

Protein and P/DM contents of non–traditional white soft cheese are presented in Table (4). The protein content of fresh cheese was 10.43, 7.08, 6.92, 6.84 and 6.99% for control, T1, T2, T3 and T4, respectively. The results indicated that there were slight differences among all the treatments due to the adjusted amount of the skim milk powder used during cheese preparations.

However, there were great differences between the control cheese and the other treatments (≤ 0.05); this wide difference in protein is due to the composition of fresh milk used in making the control cheese. The P/DM content takes the same trend of the protein content.

Lactose content:

With regard to lactose content of non–traditional white soft cheese, (Table 4), recorded 3.48, 5.34, 5.72, 5.45 and 5.47% for control, T1, T2, T3 and T4, in order. There were slight differences among cheese treatments, but there were high differences between the control cheese and the treatments in their content of lactose. This is due to the use of skim milk powder in formulating non–traditional white soft cheese which increases the lactose content. In addition, during making of the traditional white soft cheese there is drainage of some whey which takes some of lactose as soluble materials. These results are in agreement with those of Fayed *et al.*, (1988).

Analysis of variance of such component cleared that there were significant differences between all treatments including control cheese either at a level of 5% or 1% with LSD of 0.219 and 0.299, respectively.

Salt and salt-in-moisture contents:

The salt content was 3.33, 3.18, 3.23, 3.20 and 3.03% for control cheese, T1, T2, T3 and T4, in order. While salt-in-moisture content was 5.25, 5.67, 5.67, 5.66 and 5.31%, respectively. The data indicated that the non–traditional white soft cheeses made from mixture of skim milk powder, different vegetable oils and whole mixed milk had low salt contents than the control cheese (traditional cheese) and this could be attributed to the lower moisture content, and so lower salt-in-moisture percent in these cheeses.

On the other hand, there were non significant differences between all cheese treatments including the control. These findings are in agreement with that obtained by Abd El-Aty (2003).

Table (4): Chemical composition of non–traditional white soft cheese made from mixture of skim milk powder, different vegetable oils and fresh milk.

Parameter (%)	Treatments					Mean	LSD	
	Control	T1	T2	T3	T4		5%	1%
T.S	36.62[b]	43.90[a]	43.06[a]	43.52[a]	42.93[a]	**42.01**	**1.072**	**1.461**
Fat	17.75[b]	27.42[a]	27.08[a]	27.20[a]	26.75[a]	**25.24**	**0.911**	**1.242**
F/DM	48.47	62.46	62.89	62.50	62.31	**59.73**	–	–
Protein	10.43[a]	7.08[b]	6.92[b]	6.84[b]	6.99[b]	**7.65**	**0.299**	**0.408**
P/DM	28.48	16.13	16.07	15.72	16.28	**18.54**	–	–
Lactose	3.48[c]	5.34[b]	5.72[a]	5.45[ab]	5.47[ab]	**5.09**	**0.219**	**0.299**
Salt	3.33[a]	3.18[a]	3.23[a]	3.20[a]	3.03[a]	**3.19**	**N.S***	**N.S**
Salt-in-moisture	5.25	5.67	5.67	5.66	5.31	**5.51**	–	–
Ash	4.61[a]	4.00[b]	4.03[b]	3.97[b]	3.90[b]	**4.10**	**0.255**	**0.348**
Acidity	0.19[a]	0.15[a]	0.16[a]	0.16[a]	0.14[a]	**0.16**	**N.S**	**N.S**
pH value	6.35[a]	6.39[a]	6.42[a]	6.41[a]	6.42[a]	**6.40**	**N.S**	**N.S**

Control: mixed cow & buffalo's milk (1:1)
T1: 20% cocoa butter substitute (CBS) + 10% skim milk powder (SMP)
T2: 20% coconut oil + 10% skim milk powder (SMP)
T3: 20% palm oil + 10% skim milk powder (SMP)
T4: 15% palm oil + 5% coconut oil + 10% skim milk powder (SMP)
N.S*: Non significant
Values with the same letters are non significant different.

Ash content:

It is clear from the data Table(4) that control cheese had the highest ash content than other treatments, while, T4 cheese had the lowest ash content, this may be due to the composition of fat mixture in such treatment. The results also showed that there was slight variation in ash content between the non–traditional white soft cheeses which may be due to the kind of vegetable oil. These observations coincide with those reported for the salt content of these cheese treatments. These results agree with those obtained by Ara *et al.*, (2002) and Abd El-Aty (2003). The statistical analysis of the obtained data showed that there were significant differences between the control and non–traditional cheese treatments at levels of 5% and 1%. While, there were non-significant differences between the treatments from T1 to T4.

Titratable acidity and pH values:

Regarding to titratable acidity and pH values of non–traditional white soft cheese, it was recorded 0.19, 0.15, 0.16, 0.16 and 0.14% as lactic acid for control, T1, T2, T3 and T4 treatments, respectively. These results clearly indicated that control cheese had the highest value of acidity, while cheeses containing vegetable oils showed low acidity values as compared to the control cheese. The data in the same table indicated that there was a slight difference in the acidity between non–traditional treatments. This leads to that the cheese acidity is not affected greatly by vegetable oil type. These results are in agreement with those of Hallal & Al-Omar (1987); Abo El-Naga *et al.,* (1994) and Abd El-Aty (2003).

pH values of cheese of different treatments took an opposite trend to that of the acidity. However, cheese containing vegetable oils showed slightly higher pH values as compared to the control cheese, these results reflects the low amount of lactose content in the control cheese. In addition, increasing level of milk fat substitution led to slight decrease in the pH value, (Foda *et al.*, 1976).

From statistical analysis of acidity and pH values, there were non significant differences between all the non–traditional cheese treatments and traditional control cheese either at variance of 5% or 1%.

Organoleptic properties:

Organoleptic properties of non–traditional white soft cheese made from a mixture of skim milk powder, different vegetable oils and fresh milk are recorded in Table (5). The control cheese had the highest flavour value followed by T1, T3, T4 and then T2 and they were 40.8, 39.7, 34.7, 33.3 and 31.6, in order. On the other hand, body & texture of the produced cheeses gave average scores of 31.3, 31.8, 30.00, 30.00 and 29.7 for control, T1, T2, T3 and T4, respectively. All cheese treatments including the control had significant differences for appearance, whereas, the highest value was for T1 followed by control cheese, T3, T2 and the lowest one was T4.

The total scores of all produced cheeses recorded 89.5, 89.2, 78.6, 81.8 and 79.6 for control, T1, T2, T3 and T4, respectively. All the produced cheeses were accepted from organoleptic side of view; however, the best one beside the control cheese was T1 that contains 20% (CBS). This oil being considers the best vegetable oil used in non–traditional white soft cheese making among the total score of panelists.

The statistical analysis of the obtained data indicated that there were significant differences between all cheese treatments for their flavours, body & texture, appearance and total score either at variance of 5% or 1%.

Table (5): Organoleptic properties of non–traditional white soft cheese made from mixture of skim milk powder, different vegetable oils and whole mixed milk.

Characteristic	Treatments					Mean	L.S.D	
	Control	T1	T2	T3	T4		5%	1%
Flavour (45)	40.8^{a}	39.7^{a}	31.6^{b}	34.7^{b}	33.3^{b}	**36.02**	**3.457**	**4.656**
Body & texture (35)	31.3^{a}	31.8^{a}	30.0^{b}	30.0^{b}	29.7^{b}	**30.56**	**1.689**	**2.276**
Appearance (20)	17.4^{ab}	17.7^{a}	17.0^{bc}	17.1^{b}	16.6^{c}	**17.16**	**0.852**	**1.147**
Total (100)	89.5^{a}	89.2^{a}	78.6^{c}	81.8^{b}	79.6^{bc}	**83.74**	**4.041**	**5.442**

Control: Fresh cow & buffalo's milk (1:1)
T1: 20% cocoa butter substitute (CBS) + 10% skim milk powder (SMP)
T2: 20% coconut oil + 10% skim milk powder (SMP)
T3: 20% palm oil + 10% skim milk powder (SMP)
T4: 15% palm oil + 5% coconut oil + 10% skim milk powder (SMP)
Values with the same letters are non significant different.

Analysis of variance of the organoleptic results revealed that there was a non significant difference between the control cheese and T1 for all the organoleptic characteristics (flavour, body & texture, appearance and total scores). On the other hand, there were significant differences between control cheese and T2, T3 & T4 for all the organoleptic parameters either at 5% or 1% of variance.

Also, there were non significant differences between T2, T3 and T4 for flavour and body & texture. Also, these analysis cleared a significant differences for cheese appearance and total score at the two levels of analysis with LSD value of (0.852, 1.147) and (4.041, 5.442) for 5 and 1%, respectively.

In conclusions the results of chemical composition of non–traditional white soft cheeses of retails showed a large variability, especially for fat and protein levels. The marked differences in the chemical parameters of these cheeses appear to be as a result of different processing methodology and in the product formulation during the cheese making. On the other hand, the range of chemical composition is reflecting to the nutritional value of such cheese.

Also, from the forgoing results, it could be concluded that white soft cheese can be made from mixture of skim milk powder, whole mixed milk with different vegetable oils at a rate of 20% and the cheese made with CBS (T1) has good quality

white soft cheese for fresh consumption. Hence, for more study this type of vegetable oil will be a main factor for improving the quality of non–traditional white soft cheeses.

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إنتاج الجبن الطري الأبيض الغير تقليدي من اللبن الطازج مع إضافة لبن مجفف وزيوت نباتيه

في هذا البحث تم تقييم ثمانية عينات من الجبن الطري الأبيض الطازج الغير تقليدي والمضاف إليه زيوت نباتيه يتم إنتاجها محليا للسوق المصرية .وقد سجل التحليل الكيماوي للجبن متوسط محتوي من الدهن ٣٠.٣٨ % ومتوسط محتوى البروتين ٤.٤٩ % ومدى واسع لكل من الرماد والملح ، pH والحموضة وكان محتوى الجوامد الكلية (يتراوح من ٣٥.٤٤ إلى ٤٩.٦٤%) والتي تقع في نطاق المواصفات القانونية المصرية للجبن الأبيض الطري ٠

أيضا يهدف هذا البحث إلى إنتاج الجبن الطري الأبيض الغير تقليدي والمضاف إليه زيوت نباتيه و تم إنتاج جبن ابيض طرى غير تقليدي من خليط من لبن جاموسي وبقري (١ :١) مع ١٠ % لبن فرز مجفف ، ٢٠% من بديل زبده الكاكاو (T1) أو زيت جوز الهند (T2) أو زيت النخيل (T3) أو خليط من زيت جوز الهند و زيت النخيل (T4) بجانب جبن الكنترول المصنوع من خليط من لبن جاموسي وبقري (١ :١) بالطرق التقليدية (Control) وقد أظهر التحليل الكيماوي للجبن الناتج اختلاف معنوي في محتوى الجوامد الكلية للجبن المعامل عن الكنترول وسجلت المعاملة T1 المحتوية على ٢٠% cocoa butter ، ١٠ % لبن فرز جاف أعلى قيمة (٤٣.٩ %) في معاملات الجبن المصنع بالزيوت النباتية المختلفة حيث سجل زيادة معنوية في محتوى الدهن ، اللاكتوز عن الكنترول وعلى الجانب الآخر نفس المعاملات أعطت اختلافات غير معنوية في محتوى البروتين في الجبن المعامل ولكنها معنويا أقل من الكنترول ٠ وقد أظهر معاملات الجبن أيضا نقص طفيف في الحموضة وزيادة في الـــ pH والرماد ومحتوى الملح عن الكنترول.

اظهر التقييم الحسي الأفضلية لكل من الكنترول والمعاملة (T1) المحتوى على ٢٠ % بديل زبده الكاكاو CBS. والتي كانت تقارب الكنترول والتي يمكن أن يوصى البحث بإمكانية إنتاج جبن طرى وبجودة مقبولة من خليط اللبن الكامل المجفف المحتوى على ٢٠%.CBS